INTEGRATION OF AI TECHNOLOGY IN DIGITAL MARKETING LEARNING TO INCREASE INNOVATION AND STUDENT LEARNING INDEPENDENCE

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Abstract

The rapid evolution of the digital economy demands that vocational education cultivate not only technical proficiency but also 21st-century competencies such as innovation and self-regulated learning (SRL). Yet, many Indonesian vocational schools continue to employ teacher-cantered, theoretical approaches that fail to bridge the "application gap" in Digital Marketing education. This study investigates the impact of integrating generative Artificial Intelligence (AI) tools within a Project-Based Learning (PBL) framework on students' innovation and SRL. Conducted as a Classroom Action Research (CAR) using the Kemmis & McTaggart model, the intervention was implemented over two iterative cycles with 131 students from the Retail Business program at SMKN 1 Pemulutan. Data were collected through validated rubrics, 13-item SRL questionnaire ($\alpha = 0.82$), systematic observations, and project artifacts. Findings reveal a significant improvement: average innovation scores rose from 58% (pre-intervention) to 85% (post-Cycle II), with 81% of students achieving "Good" or higher. SRL scores increased by 31.8% (from 52.4% to 84.2%), and 80% of students consistently demonstrated autonomous behaviours. Qualitative analysis indicates that AI functioned as a cognitive partner that accelerated ideation, while PBL provided an authentic context for critical evaluation and creative synthesis. The study demonstrates that the synergistic integration of AI and PjBL effectively fosters both technical and dispositional competencies in vocational settings. It contributes empirical evidence to the emerging discourse on human-AI co-creativity in Global South education and offers a scalable, low-cost pedagogical model for AI-enhanced vocational teaching.

Keywords: Artificial Intelligence, Project-Based Learning, Digital Marketing, Innovation, Self-Regulated Learning, Vocational Education, Classroom Action Research

1. Introduction

Digital marketing has become a strategic imperative across global industries. Organizations increasingly rely on data-driven, personalized, and agile marketing strategies to engage consumers in dynamic digital ecosystems (Chaffey & Ellis-Chadwick, 2022). This transformation demands a new generation of professionals equipped not only with technical fluency in digital platforms but also with adaptive cognitive dispositions such as innovation, critical thinking, and self-regulated learning (Sawyer, 2023). The World Economic Forum (2023) identifies these as core 21st-century competencies essential for employability in the digital economy.

Vocational education systems worldwide are under mounting pressure to align curricula with these evolving industry expectations. In Indonesia, the Ministry of Education's Merdeka Curriculum

explicitly integrates digital marketing into vocational programs such as Retail Business to produce "job-ready" graduates (Kemendikbudristek, 2022). Despite this policy alignment, classroom implementation often lags. Pedagogical practices remain anchored in teacher-centered, lecture-based models that prioritize theoretical knowledge over authentic application (Anugrah et al., 2024; Raharjo, 2020). Students rarely engage in end-to-end campaign design, data interpretation, or strategic iteration—processes central to real-world digital marketing practice.

This disconnects manifests as a critical "application gap." Students may memorize definitions of SEO or social media metrics yet struggle to formulate data-informed strategies or adapt to algorithmic changes on platforms like TikTok or Instagram (Sevenstar Indonesia, 2025). The gap is exacerbated by limited access to industry-standard tools such as Google Analytics or Meta Ads Manager, as well as insufficient teacher training in emerging digital technologies (Vokasi.net, 2025). Consequently, graduates often enter the workforce unprepared for the creative and autonomous demands of digital roles.

Artificial Intelligence (AI) presents a disruptive opportunity to bridge this gap. Generative AI tools—ranging from large language models (e.g., ChatGPT) to AI-powered design suites (e.g., Canva Magic)—can automate routine tasks such as keyword research, content drafting, and visual prototyping (Buffer, 2025; ClickUp, 2025). This automation liberates cognitive resources, enabling learners to focus on higher-order strategic and creative functions (Sweller, 2023). More importantly, AI can serve as a cognitive partner that scaffolds experimentation, rapid prototyping, and iterative refinement—core processes of innovation (Verawati, 2024).

However, the mere presence of AI does not guarantee pedagogical transformation. Its educational value depends on intentional integration within constructivist learning frameworks that emphasize authentic problem-solving, reflection, and critical evaluation (Luckin et al., 2022; Holmes et al., 2022). This study investigates how embedding generative AI within a Project-Based Learning (PjBL) model can systematically enhance two interdependent outcomes: innovation defined as the generation of original, data-driven marketing strategies and self-regulated learning (SRL)characterized by initiative, planning, problem-solving, and self-evaluation (Zimmerman, 2002). Conducted in an Indonesian vocational high school context, this research contributes empirical evidence to the underexplored nexus of AI, vocational education, and 21st-century skill development in the Global South.

2. Theoretical Framework

The conceptual foundation of this study rests on a synergistic integration of three interrelated theoretical perspectives: constructivist learning theory, sociocultural theory, and the self-regulated learning (SRL) model. Together, these frameworks elucidate how AI-mediated Project-Based Learning fosters both innovation and learner autonomy in vocational digital marketing education. Constructivist theory posits that knowledge is actively constructed through engagement with authentic, problem-based tasks rather than passively received through instruction (Piaget, 1970; Jonassen, 1999). In vocational contexts, this implies that students learn most effectively when immersed in realistic professional scenarios—such as designing a full digital campaign for a hypothetical product—where they must apply, test, and refine concepts in situ (Raharjo, 2020; Thomas, 2000). Project-Based Learning (PBL) operationalizes this principle by structuring learning around extended, goal-oriented projects that mirror industry workflows. PBL has been empirically

validated in vocational settings for its capacity to enhance motivation, collaboration, and practical skill transfer (Capraro et al., 2013; Han et al., 2021).

Sociocultural theory, rooted in Vygotsky's (1978) work, emphasizes that cognitive development is mediated by cultural tools and social interaction. From this perspective, AI is not a neutral technology but a cultural artifact that functions as a psychological instrument extending human cognition (Wertsch, 1998). Generative AI tools mediate the learning process by offloading procedural tasks (e.g., generating draft copy or analyzing keyword trends), thereby reducing extraneous cognitive load and enabling students to focus on strategic interpretation and creative synthesis (Sweller, 1988; Mayer, 2021). Crucially, effective tool use occurs within a Zone of Proximal Development (ZPD), where teacher scaffolding gradually enables students to internalize AI as a cognitive partner (Holmes et al., 2022).

Zimmerman's (2002) SRL model provides the third pillar. SRL conceptualizes learning as an active, cyclical process involving forethought (goal setting, planning), performance (self-monitoring, strategy use), and self-reflection (self-evaluation, adaptation). In digital environments, SRL manifests as initiative in seeking resources, confidence in troubleshooting technical issues, and reflective evaluation of campaign outcomes (Mujiman, 2018; Pintrich, 2000). AI can support each SRL phase: analytics provide real-time feedback for monitoring, adaptive prompting encourages strategic planning, and iterative interaction cultivates resilience (Verawati, 2024). Yet, without explicit instruction in metacognitive strategies—such as critical evaluation of AI outputs students risk becoming passive consumers of algorithmic suggestions (Bauer & Kenton, 2023).

Innovation and SRL are not parallel outcomes but deeply interdependent. Innovation in digital marketing emerges not from isolated creativity but from disciplined inquiry, experimentation, and refinement behaviours cultivated through SRL (Sawyer, 2012). A self-regulated learner treats AI as a collaborator, probing its outputs with scepticism, refining prompts through trial and error, and synthesizing machine-generated ideas with human insight. This dynamic reflects "human-AI co-creativity," where value lies in the learner's capacity to curate, critique, and transform AI output (Shneiderman, 2022; ClickUp, 2025).The integration of these perspectives yields a coherent framework: AI, when embedded within a PBL structure and scaffolded through SRL principles, reconfigures cognitive labour, cultivates critical co-creativity, and transforms learner agency. This model moves beyond techno-determinism to position AI as a catalyst within a human-cantered pedagogical ecosystem.

Table 1.Theoretical Constructs, Operational Definitions, and Supporting Literature

Project Phase	AI Tool(s)	Student Activity	Observed Indicator
Market & Audience Research	Google Trends, ChatGPT	Analyze search trends; generate Gen-Z audience personas	Innovation: Proposes novel comparisons Autonomy: Explores related queries independently
Content Ideation	Gemini, Canva Magic Design	Generate and refine social media captions & visuals	Innovation: Combines/modifies AI outputs creatively Autonomy: Troubleshoots design issues without teacher help
Keyword Strategy	seo.ai, Google Keyword Planner	Identify and categorize short-	Innovation: Designs keyword clusters Autonomy:

		and long-tail keywords	Classifies keywords by search intent
Campaign Justification	ChatGPT	Simulate stakeholder Q&A for strategy defense	Innovation: Anticipates and addresses weaknesses Autonomy: Prepares data-driven rebuttals proactively

3. Methodology

This study employed a Classroom Action Research (CAR) design grounded in the cyclical model proposed by Kemmis and McTaggart (1988). This methodological approach was selected for its capacity to facilitate context-sensitive, practice-oriented inquiry aimed at improving both teaching processes and student learning outcomes within authentic classroom settings. The iterative structure of planning, acting, observing, and reflecting aligns with the principles of participatory and improvement-focused research in educational contexts (Mills, 2023; Stringer, 2022).

The research was conducted over two consecutive cycles during the first semester of the 2025/2026 academic year at SMKN 1 Pemulutan, a vocational high school in South Sumatra, Indonesia. Participants comprised 131 students enrolled in Grades X and XI of the Retail Business program, all concurrently taking the Digital Marketing course. This cohort was selected purposefully based on preliminary diagnostic assessments that revealed persistent challenges in innovation and self-regulated learning—issues directly aligned with the study's objectives (Creswell & Poth, 2023).

The intervention centered on the integration of generative Artificial Intelligence (AI) tools within a Project-Based Learning (PjBL) framework. Students engaged in a comprehensive, authentic project: designing a digital marketing campaign for a hypothetical organic energy drink targeting Generation Z consumers. The project spanned four core phases—market research, content ideation, keyword strategy, and campaign justification—each scaffolded through the guided use of free or freemium AI tools such as Google Trends, ChatGPT, Canva Magic Design, and seo.ai. Cycle I emphasized basic AI prompting and structured task execution under close teacher guidance. Cycle II introduced advanced prompting techniques, critical evaluation of AI outputs using the F.A.C.T. principles (Fact-checking, Attribution, Context, Transparency), and reduced scaffolding to foster greater student autonomy (Holmes et al., 2022; Verawati, 2024).

Data were collected through a mixed-methods triangulation strategy to ensure validity and depth of insight. Quantitative data were gathered via a validated 13-item Likert-scale questionnaire measuring five dimensions of self-regulated learning ($\alpha = 0.82$), administered as a pre-test before Cycle I and a post-test after Cycle II. Innovation was assessed through an analytic rubric applied to final project artifacts ($\alpha = 0.87$). Qualitative data were derived from systematic classroom observations conducted by the researcher and a peer observer using a structured protocol, supplemented by photographic documentation, student work samples, and reflective field notes. All instruments underwent pilot testing and contextual validation to ensure reliability and cultural appropriateness (Fraenkel et al., 2022).

Data analysis followed an integrated mixed-methods approach. Quantitative data from the SRL questionnaire and rubric scores were analyzed using descriptive statistics, including mean scores, percentage changes, and achievement rates against predefined success indicators (≥75% of students scoring "Good" or higher in innovation; ≥20% increase in average SRL score). Qualitative

observational data underwent thematic analysis using Miles and Huberman's (1994) interactive model, involving data reduction, display, and conclusion drawing. Findings from both data streams were synthesized during the reflection phase of each cycle to inform iterative refinements. Ethical considerations included informed consent, anonymization of student work, and voluntary participation with no academic penalties (Bryman, 2021).

4. Results

The implementation of Artificial Intelligence (AI)-based interventions based on Artificial Intelligence (AI) integration within the Project-Based Learning (PjBL) framework resulted in significant improvements in two main variables: innovation and learning independence. Data were collected through instrument triangulation—project assessment rubrics, Likert scale questionnaires, structured observations, and digital artifact documentation—and analyzed comparatively between conditions at the beginning, end of Cycle I, and end of Cycle II.

The level of student innovation has increased progressively throughout the two cycles. In the initial condition, the average score of innovation was 58%, with the majority of projects showing repetitive ideas, minimal data analysis, and passive use of digital tools. After Cycle I, the average score increased to 72%. This improvement is especially seen in the early ideation abilities thanks to the help of AI. However, many students still use AI output raw without creative modifications. At the end of Cycle II, the average score reached 85%, exceeding the established success indicators.

Qualitative changes in innovative behavior were also observed consistently. In Cycle I, students tend to follow the prompts given by the teacher and receive AI results without critical evaluation. In Cycle II, after training in advanced prompting techniques and the principles of F.A.C.T. (Fact-checking, Attribution, Context, Transparency), students begin to experiment with complex prompt combinations, verify AI recommendations against external data, and synthesize the outputs of several tools into an original campaign strategy. Some groups even use AI to simulate the responses of fictitious audiences as the basis for justifying their content design.

Learning independence shows a parallel upward trend. The average score of the learning independence questionnaire increased from 52.4% at baseline to 84.2% at the end of Cycle II—an increase of 31.8%. Behavioural observations reinforce these findings. In the initial condition, about 65% of students often ask the teacher for help with basic technical problems. In Cycle II, this proportion dropped to 20%. As many as 80% of students consistently show initiative in finding independent solutions, such as watching tutorials on YouTube, reading tools documentation, or having internal discussions in groups without teacher intervention.

Self-reliance behaviour is also seen in project management. Students begin to organize task divisions autonomously, set internal deadlines, and conduct periodic evaluations of the progress of their projects. They no longer wait for explicit instructions for each step. Instead, they take full responsibility for their learning process and outcomes, in accordance with the principle of self-regulation in Zimmerman's theory (2002). These quantitative and qualitative findings are summarized in Table 2, which maps systematic changes in both main variables throughout the research stage.

Table 2.Quantitative Trajectory of Innovation and Self-Regulated Learning Across Research Phases

Variable	Measurement Phase	Mean Score (%)	% of Students Meeting Success Threshold*	Change from Baseline
Innovation	Pre-Intervention	58%	30%	—
	End of Cycle I	72%	62%	+14%
	End of Cycle II	85%	81%	+27%
Self-Regulated Learning (SRL)	Pre-Intervention	52.4%	—	—
	End of Cycle II	84.2%	80%	+31.8%

5. Discussion

The findings of this study show that the integration of Artificial Intelligence (AI) in the Project-Based Learning (PBL) framework significantly increases the innovation and learning independence of vocational school students. These results do not appear by chance. The increase is a direct consequence of a pedagogical design that deliberately incorporates constructivist principles, social mediation, and self-regulation. AI functions not as a substitute for teachers, but rather as a cognitive tool that expands students' capacity to think strategically and experiment safely.

increase in innovation from an average score of 58% to 85% reflects a fundamental shift in the way students interact with technology. At the beginning of the intervention, AI was used as a passive answer engine. Output is accepted without criticism. At the end of Cycle II, AI transforms into a collaborative partner. Students begin formulating complex prompts, verifying recommendations against external data, and synthesizing ideas from multiple *tools*. This behavior is in line with *the concept of human-AI co-creativity* proposed by Shneiderman (2022). Innovation is no longer measured by absolute originality, but rather by the critical ability to select, modify, and combine digital resources into valuable solutions.

Learning independence shows a parallel upward trend. An increase in average scores of 31.8% and consistency of independent behaviour in 80% of students indicated a change in learning orientation. Students move from external dependency to internal regulation. These findings support Zimmerman's (2002) Self-Regulated Learning (SRL) model. AI acts as *an adaptive scaffold* that is available at any time. When faced with technical problems, students no longer wait for the teacher's instructions. They look for solutions through online tutorials, experiment *prompts*, or internal group discussions. This process reinforces self-efficacy and cognitive responsibility—two of the main pillars of SRL.

The synergy between PBL and AI creates an ideal learning environment for 21st century competency development. PBL provides an authentic context that demands strategic applications. AI provides a cognitive infrastructure that allows for deep exploration without procedural barriers. This combination reduces extrinsic cognitive load (Sweller, 1988), freeing up mental resources for high-level tasks such as audience analysis, strategic justification, and critical reflection. These results

reinforce the argument that digital transformation in vocational education should focus on *cognitive redistribution*, not just technology adoption.

These findings also challenge deterministic narratives about AI in education. The success of the intervention is not determined by the sophistication of the tools, but rather by the quality of pedagogical integration. Cycle I show that access to AI without critical guidance strengthens passive consumption. Only after explicit training in the principles of F.A.C.T. (Fact-checking, Attribution, Context, Transparency) and *prompt engineering* do students begin to exhibit innovative and independent behaviour. This confirms that AI literacy the ability to interact ethically, critically, and strategically with AI systems should be a core component in the modern vocational education curriculum (Holmes et al., 2022).

The main contribution of this research lies in its context. Most of the studies on AI in education come from developed countries with advanced infrastructure. This study shows that a similar model can be effectively implemented in vocational high schools in the Global South using free *tools* and basic infrastructure. This paved the way for large-scale replication in developing countries. The integration of AI in PBL is not a technological luxury, but a realistic and impactful pedagogical strategy to bridge the digital skills gap in the era of the Industrial Revolution 4.0.

6.Conclusion

This study provides empirical evidence that the integration of Artificial Intelligence (AI) in the framework of Project-Based Learning (PBL) effectively increases the innovation and learning independence of vocational school students in the subject of Digital Marketing. The significant increase from an average innovation score of 58% to 85% and learning independence from 52.4% to 84.2% shows that AI is not just a technical tool, but rather a pedagogical catalyst that enables cognitive redistribution from procedural tasks to strategic and creative functions. These findings reinforce the *human-AI co-creativity* theory and affirm that the value of AI in education lies in its human-cantered, critical, and contextual integration design. This study contributes to the vocational education literature in the Global South by offering a scalable model that leverages free *tools* to bridge the digital skills gap. The implications are clear: 21st-century vocational education must adopt an approach that not only teaches technology but also forms innovative and independent attitudes through reflective interaction with it. Further research is suggested to explore the sustainability impact of these interventions on job readiness and cross-disciplinary adaptability.

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